

AD-767 937

PRODUCTION DATA PACKAGE 267 GALLON
EXTERNAL FUEL TANK

Albert E. Simkins

Naval Air Development Center

Prepared for:

Naval Air Systems Command

23 August 1973

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A production data package was developed for a 267 gallon external fuel tank suitable for use on the F-14 aircraft.

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23 August 1973

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PHASE REPORT

AIRTASK A05-530-001/202-1/17X15050
WORK UNIT 530-2

A production data package was developed for a 267 gallon external fuel tank suitable for use on the F-14 aircraft.

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INTRODUCTION

The F-14 aircraft carries two 267 external fuel tanks which were designed and fabricated by Grumman Aerospace Corporation. To procure these tanks competitively the design and quality assurance requirements must be detailed to assure interchangeability and reliability. Such a production data package was prepared at the NAVAIRDEVCON (Naval Air Development Center) under AIRTASK AC5-530-001/202-1/17X15050, Work Unit 530-2. The fuel tank, hereafter identified as the FPU-1/A, described in this data package, was designed specifically for the F-14 aircraft.

DETAILS

The production data package, Appendix A, contains:

- a. List of detailed engineering drawings
- b. Design requirements
- c. Quality assurance provisions

The Grumman Aerospace drawings, together with the design requirements provide the information to fabricate a FPU-1/A external fuel tank. It should be noted that the drawings containing flat patterns listed in Table I are non-dimensional, and full size reproductions of these drawings on stable material in accordance with MIL-D-8510 must be furnished to the manufacturer to insure accurate fabrication.

Normally the drawings would have been validated by comparing the drawings and parts in accordance with the procedures of NAVAIR Instruction 4330.10. Although a cursory inspection of the parts and the assembled tank has been accomplished and the drawings reviewed, due to a probable delay in the use of this data package and the probability of changes to the tank in the interim, the NAVAIRSYSCOM (Naval Air Systems Command) directed that the dimensional check of the tank and components should be accomplished at a later date. Discrepancies found during the drawing review are listed in Appendix A, Section 2.

The design requirements of Appendix A, Section 3, provide additional design criteria not contained on the detail drawings.

The quality assurance provisions, Appendix A, Section 4, are divided into the first article and quality conformance tests and contain the examinations and tests to be performed to assure that the fuel tanks procured with this data package are of acceptable quality. The long duration tests such as forced ejection, slosh vibration and load which verify the design requirements, are contained in the first article test. The quality conformance tests required for every production tank consist of non-destructive tests, examination of product, welding inspection and pressure and functional test, and are to be performed on each tank to examine those characteristics most

affected by variations in production. A slosh vibration test is to be conducted on a lot sample basis. The lot sample items are not suitable for delivery after testing.

The critical loadings and the areas affected as defined by reference (a) are as follows:

1. 70 PSI pressure test - the trough area and aft horizontal truss
2. Forced ejection - the tank shell shears and bending moment
3. Catapult - the aft yaw pin
4. Load condition 196L - the front spar
5. Load condition 6 - the hook fitting support channel and log fitting

The pressure tests are based on 35 PSIG, (1.25 X normal operating pressure and the maximum relief valve setting) and negative 2 PSIG, the minimum operating pressure. The nose section has been designed and tested to an ultimate negative pressure of 10 PSIG, reference (b).

TABLE I
Non-Dimensional Drawings

Grumman Aerospace Corporation Drawing No.

A51B71005
↑ 07
10
13
17
19
20
21
25
27
↓
A51B71031

A51P71100
↑ 02
03
05
07
08
↓
A51P71123
A51F71310

CONCLUSIONS

The information contained in Appendix A is considered to be adequate for the competitive procurement of FPU-1/A external fuel tanks for use on the F-14 aircraft.

Higher production rates, normally associated with contracts for replenishment of spare parts offer an excellent opportunity for value engineering.

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RECOMMENDATION

It is recommended that the drawings be validated in accordance with NAVAIRINST 4333.10 and the data package, Appendix A, be used for competitive procurement of the FPU-1/A external fuel tank.

REFERENCES

- (a) GAC A51-314-R-49.08, Test Plan for 267 Gallon Auxiliary Fuel Tank Static Test
- (b) GAC A51-314-R-46.11, Results of Miscellaneous Component Static Tests

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APPENDIX A

PRODUCTION DATA PACKAGE
TANK FUEL AIRCRAFT AUXILIARY EXTERNAL
267 GALLON

APPENDIX A

PRODUCTION DATA PACKAGE
TANK FUEL AIRCRAFT AUXILIARY EXTERNAL 267 GALLON

1. SCOPE

1.1 Scope - This document contains the design and test requirements for a 267 gallon external fuel tank for use on the F-14 aircraft.

2. APPLICABLE DOCUMENTS

2.1 Applicable documents - The following documents of the issue in effect on the date of invitation for bid or request for proposal, form a part of this document to the extent specified herein.

SPECIFICATIONS

Military

MIL-D-1000	DRAWING, ENGINEERING AND ASSOCIATED LIST
MIL-T-5021	TEST, AIRCRAFT & MISSILE WELDING OPERATORS
	QUALIFICATION
MIL-C-5541	CHEMICAL FILMS AND CHEMICAL FILM MATERIAL
	FOR ALUMINUM AND ALUMINUM ALLOY
MIL-F-5624	TURBINE FUEL, AVIATION GRADES JP-4 AND JP-5
MIL-VV-6858	WELDING RESISTANCE, ALUMINUM, MAGNESIUM,
	NON-HARDENING STEEL OR ALLOYS, NICKEL ALLOYS
	HEAT RESISTING ALLOYS & TITANIUM ALLOYS,
	SPOT & SEAM
MIL-I-6866	INSPECTION PENETRANT METHOD OF
MIL-V-7173	VIBRATION TEST OF FUEL, OIL AND MISC.
	TANKS PROCESS FOR
MIL-S-7742	SCREW THREADS STANDARD OPTIMUM SELECTED
	SERIES GENERAL SPECIFICATION FOR
MIL-W-8604	WELDING OF ALUMINUM, PROCESS FOR
MIL-F-8615	FUEL SYSTEM COMPONENTS, GENERAL SPECIFICATION
	FOR
MIL-S-8879	SCREW THREADS, CONTROLLED RADIUS ROOT WITH
	INCREASED MINOR DIAMETER, GENERAL SPECIFI-
	CATION FOR
MIL-P-23377	PRIMER COATING, EPOXY POLYAMIDE CHEMICAL
	AND SOLVENT RESISTANT
MIL-M-43719	MARKING MATERIAL AND MARKERS, ADHESIVE,
	ELASTOMERIC, PIGMENTED, GENERAL SPECIFICA-
	TION FOR
MIL-C-81773	COATING, POLYURETHANE, ALIPHATIC, WEATHER
	RESISTANT
Naval Air Systems Command	
SD-24	GENERAL SPECIFICATION FOR DESIGN AND CON-
	STRUCTION OF AIRCRAFT WEAPON SYSTEM

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STANDARDS

Military

MIL-STD-105	SAMPLING PROCEDURES AND TABLES FOR INSPECTION BY ATTRIBUTES
MIL-STD-130	IDENTIFICATION MARKING OF U.S. MILITARY PROPERTY
MIL-STD-143	SPECIFICATION AND STANDARDS ORDER OF PRECEDENCE FOR THE SELECTION OF
MIL-STD-453	INSPECTION, RADIOGRAPHIC
MIL-STD-480	CONFIGURATION CONTROL ENGINEERING CHANGES DEVIATIONS AND WAIVERS
MIL-STD-481	CONFIGURATION CONTROL ENGINEERING CHANGES DEVIATION AND WAIVERS, SHORT FORM

PUBLICATION

Air Force - Navy Aeronautical Bulletins	
ANA 438	AGE CONTROLS OF AIR SENSITIVE ELASTOMERIC ITEMS

DRAWINGS

Grumman Aerospace Corporation

A51P71000	TANK ASSY., EXTERNAL FUEL, 267 GAL
A51B71000	TANK ASSY STRUCTURAL EXTERNAL FUEL TANK
01	CENTER SECTION ASSY EXTERNAL FUEL TANK
02	NOSE SECTION ASSY
03	TANK ASSY, AFT SECT
04	TAIL ASSY
05*	WEB ASSY
07*	WEB ASSY HORIZ.
08	TROUGH ASSY CENTER SECTION
09	FRAME ASSY STA. 71.250
10*	FRAME ASSY
11	NOSE SECTION ASSY
12	SKIN ASSY
13*	SKIN ASSY, CENTER SECTION LOWER
16	DOME ASSY AFT SECTION
17*	FRAMES - DROP TANK STA. 155, 174 & 89 25
18	TAIL CON.
19*	SKIN FIN
20*	FRAME, TROUGH
21*	FAIRING
A51B71022	COVER ASSY, ACCESS

* Non-dimensional drawings

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DRAWINGS (cont.)

Grumman Aerospace Corp. (cont.)

A51B71023	GASKET
24	BRACKET
25*	SUPPORT
26	SKIN ASSY, AFT SECTION STA. 145-192
A51B71027*	STIFFENERS, FIN
A51B71028	BLOCKS
A51B71031*	SUPPORT
A51B71501	FITTING, LUG
02	FITTING, SWAY BRACE
03	FITTING YAW
04	FITTING YAW
05	FRAME
09	BUSHING LUG
A51B71510	FITTING, EJECTOR-BACK UP
A51B00800	LINES - EXTERNAL FUEL TANKS 267 GALLON
A51F7130	MARKING INSTL., FINISH, EXTERNAL FUEL TANK
A51F71310*	PLAT MARKING TANK FUEL AIRCRAFT EXTERNAL
A51P71100*	BRACKET, HIGH LEVEL PILOT VALVE
102*	BRACKET
03*	BRACKET ASSY
04	BLOCK, ALIGNMENT
05*	BRACKET, ASSY SHUT OFF VALVE
07*	BRACKET ASSY LOW LEVEL PILOT VALVE
08*	SUPPORT LOW LEVEL PILOT VALVE
10	TUBE ASSEMBLIES
11	TUBE ASSY
12	TUBE ASSY UPPER VENT
A51P71113	TUBE ASSY OVERBOARD VENT
A51P71115	TANK ASSY VENT
16	INLET ASSY VENT TANK EXT FUEL TANK
17	OUTLET ASSY VENT TANK EXT FUEL TANK
18	TUBE
19	COVER
20	OUTLET ASSY
22	FILTER FUEL
23	BELLMOUTH FUEL OUTLET EXT FUEL TANK
28*	STRAP DISCONNECT CLAMP
A51P71129	VALVE ASSY INERTIA, EXT FUEL TANK
A51P71130	PLATE INERTIA CHECK VALVE EXT FUEL TANK

* Non-dimensional drawings

DRAWINGS (cont.)

Grumman Aerospace Corp. (cont.)

A51P71501	BOSS, WATER DRAIN
03	BOSS, TROUGH DRAIN OVERBOARD
A51P71504	BOSS, VENT RELIEF OVERBOARD
A51P71507	FLANGE
A51DCVAD 005A	MEASURING SET FUEL QUANTITY, DESIGN CONTROL SPECIFICATION
A51DCVPJ 007	VALVE CONTROL FUEL LEVEL DROP TANK, DESIGN CONTROL SPECIFICATION
026	VALVE PRESSURE VENT DROP TANK, DESIGN CONTROL SPECIFICATION
A51DCVPJ 032	DISCONNECT BREAKAWAY - DROP TANK, DESIGN CONTROL SPECIFICATION
GC 550CF	FLANGE
GL 521 A	LUG SUSPENSION, EXTERNAL FUEL TANK
A51P9108	VALVE CONTROL FUEL LEVEL
9141	VALVE INERTIA CHECK
9144	VALVES PRESSURE VENT
9151	DISCONNECT BREAKAWAY
A51P9155	GAGE SIGHT
A51A9009	MEASUREMENT SET FOR QUANTITY

GRUMMAN STANDARDS

G220	TUBE CLAMP
G250	SEALANT
GB11D	BRACKET
GB511E	BOLT
GC500BK	CLAMP
GC550CF	COUPLING
GC550GR	COUPLING
GH11F	FLANGE
GL521A	LUG SUSPENSION
GM4004221	SHIM
GM41071	SEALANT
GN512J	NUT COLLAR
GP105L	FOAM, PLASTIC
GR500L	RIVET
GR501C	RIVET
GR501L	RIVET
GS 12D	SHIM
GS 18D	SEAL
GS28A	

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GRUMMAN STANDARDS (cont.)

GS 30A	
B	
C	
GS 30F	
GS 31B	
GS 180A	STANDARD SHAPE
GS 183A	STANDARD SHAPE
GS 570J	SEAL-O-RING
GS 830B	SLEEVE
GV 500MH	VALVE
GW 10	WASHER

GRUMMAN STANDARD SPECIFICATION

GSS 1700	SHIM
4710	MARKING
4711	
5100	
8656	
14105	SEALANT
14310	SEAL
15302	RIVET
15330	INSERTS
16100	FORGING
17403	SWAGING
GSS 17405	

2.2 This document shall take precedence over subsidiary specifications or documents. The subsidiary specifications shall take precedence over the drawings.

2.3 The applicable drawings shall be modified as follows:

A51B71022	Zone 5 Change A51B71015 to A51B71026
A51B71023	-17 Outside dimensions match with A51P71117 and A51P71116

3. REQUIREMENTS

3.1 First article - The fuel tanks furnished under this data package shall be a product which has been inspected and has passed the first article inspections specified herein.

3.2 Selection of specifications and standards - Specifications and standards for necessary commodities and services not specified herein shall be selected in accordance with MIL-STD-143.

3.3 Design - The fuel tank shall be designed and constructed in accordance with the requirements listed herein and Grumman drawing A51P71000.

3.3.1 Strength - Strength shall be provided in the tank and suspension system for the loads specified in Table 1.

3.3.2 Fuel transfer system - The pressure fueling and transfer system shall be designed and constructed to withstand and operate at an internal fueling pressure of 60 PSIG.

3.3.2.1 Proof pressure - The internal leakage rate of the line mounted fueling and transfer valve when held in the closed position by action of the high level pilot valve shall not exceed 50cc per minute at a fluid pressure of 60 PSIG.

3.3.2.2 Burst pressure - The pressure fueling and transfer system, exclusive of the tank shell, shall be capable of withstanding without evidence of rupture or breakage, an internal fuel pressure of 180 PSIG.

3.3.2.2 Usable fuel - The usable fuel capacity shall be 267 to 294 gallons.

3.3.2.3 Tank shell pressure - The tank shell shall successfully withstand the pressure tests specified in Section 4.

3.3.3 Drains - Drain openings shall be provided as specified on the applicable drawings. The drain valve shall be in accordance with MS29571 and be removable from outside the tank.

3.3.4 Pressure relief - Provision shall be incorporated in the tank which relieves both positive and negative pressure differentials between the tank and the ambient atmospheric pressure. The pressure relief valve shall provide relief at 30 ± 5 PSIG.

3.4 Finish -

3.4.1 Aluminum alloy surface treatment - The internal and external surface of the tank shall be treated in accordance with MIL-C-5541.

3.4.1.1 External finish - All external surfaces shall be painted. Paint shall consist of MIL-P-23377 epoxy primer (0.0006 to 0.0009 inches dry film thickness) top coated with MIL-C-81773 aliphatic polyurethane color #17875. FED-STD-595 (top coat dry film thickness 0.0010 to 0.0015 inches) after MIL-C-5541 surface treatment to obtain adequate paint adhesion.

3.5 Welding - Fusion welding shall be in accordance with MIL-W-8604, resistance, spot and seam welding shall be in accordance with MIL-W-6858.

3.5.1 Welders' certification - Welding shall be performed by personnel certified in accordance with MIL-T-5021.

3.5.2 Welding inspection -

3.5.2.1 X-Ray inspection - X-Ray inspection shall be performed in accordance with MIL-STD-453.

3.5.2.2 Dye penetrant inspection - A dye penetrant inspection shall be in accordance with MIL-I-6866.

3.6 Identification - Each part or assembly shall be identified in accordance with MIL-STD-130.

3.6.1 Exterior Decalcomania - A decalcomania shall be furnished that conforms to MIL-M-43719. The decalcomania shall be located on the tank exterior near the filler cap and shall be legibly filled with the following information:

TANK, FUEL, AIRCRAFT, EXTERNAL.

Type Designation - FPU-1/A

Tank Material

Capacity - (in U.S. Gallons)

Weight Empty

Manufacturer's Part No.

Manufacturer's Serial No.

Contract or Order No.

Manufacturer's Name or Trademark

Tech. Dir. Com. - (Contractor leave space for
future use)

U.S. Property

3.6.2 Serial numbers - The serial number and the manufacturer's trademark shall also be stamped near the suspension provisions of the tank. The serial number shall contain the manufacturer's initial or other information to facilitate identification of the supplier when the complete serial number is given.

3.6.3 Internal name plate - A metal name plate shall be securely affixed to an internal structural component in such a manner as to be visible and accessible through one of the access doors. The information included on the name plate shall be identical to that specified in paragraph 3.6.1.

3.6.4 Identification of "O" rings and rubber seals - The part numbers and the manufacturer's name and address for all replaceable "O" rings and rubber seals used in the tanks shall be noted on the tank manufacturer's assembly drawings.

3.6.5 Cure dates - The age of synthetic rubber parts shall be identified on each unit in accordance with ANA Bulletin No. 438.

3.6.6 Identification of fuel and vent system components - An identification plate conforming to MIL-STD-130 shall be securely attached to each separate piece of equipment, except tubing, and shall contain the following information:

Name of part
Part number (in accordance with applicable drawing)
Manufacturer's serial number (if applicable)
Manufacturer's name or trademark

3.7 Screw Threads - Screw threads shall be in accordance with MIL-S-8870 or MIL-S-7742. The conditions governing the selection of the applicable threads are described in SD-24. All threaded parts shall be securely locked by safety wiring, metal type self-locking nuts, cotter pins or other means approved by the Naval Air Systems Command.

3.8 Weight - The empty tank shall weigh not more than 230 pounds.

3.9 Capacity - The tank shall contain 267 gallons of fuel when in the level attitude. The gross capacity shall not exceed 297.7 gallons.

3.10 Center of gravity - The center of gravity of the empty tank shall be located at station 114.5 \pm 1 inch.

3.11 Aerodynamic smoothness - Variations from the nominal contour of the tank as shown on the accompanying table of offsets shall not exceed the dimension shown herein when measured with a spline over a distance of six inches in any direction including weld bead height. The nominal dimension variation for the first third of the tank shall be \pm .032 inches and \pm .050 inches for the remaining two-thirds of the tank. All external screws, rivets, etc. shall be flush.

3.12 Cleaning - Each tank component shall be thoroughly cleaned of dirt, chips, sand, or other foreign matter while being assembled and after final assembly.

3.13 Changes and modifications - Approval of the Contracting Officer shall be required prior to change or modification of any of the items (a) through (1). Approval of the Contracting Officer shall also be required prior to incorporating any Class I design modification after completion and approval of first article tests. In addition the requirements of MIL-STD-430 any change which affects the following items shall be also considered as Class I changes:

- (a) External contour of the tank
- (b) Shape or location of fins
- (c) Location or configuration of mounting lugs

- (d) Location or attaching provisions for external service fittings (fuel, air, or electrical)
- (e) Arrangement of external plumbing
- (f) Arrangement and configuration of valves
- (g) External finish requirements
- (h) Packing requirements and markings
- (i) Arrangement of drains
- (j) Source change of components
- (k) Change in any process which affects the performance of any part (functional and/or strength)

Class I and Class II engineering changes shall be submitted for approval in accordance with MIL-STD-481. Copies of all Class II changes shall be furnished to the Naval Air Development Center, Air Vehicle Technology Department, Code 3053, Warminster, Pa. 18974 for approval. Incorporation of changes after the first article approval may require repeating appropriate portions of the first article test.

Request for approval of modification shall state the reason for such proposed change, and requests involving changes or substitution of any component shall further include a report of a successful qualification test to establish that the intended replacement is equivalent to the component for which replacement is desired and that it conforms to the requirements of Specification MIL-F-8615. Concerning the location of components; where conflict exists between the drawings and the requirements of the contract, the requirements of the contract shall take precedence.

3.14 Interchangeability - All parts having the same manufacturer's part number shall be directly interchangeable with each other with respect to installation and performance. Changes in manufacturer's part number shall be governed by the number requirements of MIL-D-1000.

3.15 Workmanship - Workmanship shall be of the quality necessary to produce a tank free from all defects which may affect proper functioning in service.

3.16 Drawing - One complete set of detail drawings prepared in accordance with MIL-D-1000 Category E shall be submitted to the Naval Air Development Center and two sets to the Naval Air Systems Command 30 days after final acceptance of the first article tests.

4. QUALITY ASSURANCE PROVISION

4.1 Responsibility for inspection - Unless otherwise specified the supplier is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or order the supplier may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the

Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure that supplies and services conform to prescribed requirements.

4.1.1 Satisfactory performance - The failure of a tank to meet the specified requirements of any of the following tests shall constitute failure of the tank. Rejected tanks shall not be resubmitted for inspection without furnishing to the Government Inspector full particulars concerning the measures taken to overcome the defect. Upon resubmission of the tank for test after a failure, the test shall start at the beginning of the test during which failure had occurred.

4.2 Classification of tests - The inspection and testing of tanks shall be classified as follows:

a. First article tests - The first article tests are those tests accomplished on samples to determine their suitability for specific installations specified by the procuring activity.

b. Quality conformance tests - Quality conformance tests are those tests accomplished on tanks manufactured and submitted for acceptance under contract.

4.3 First article tests - From the first ten tanks, which are made under production methods and conditions and are fabricated on production tooling, a sample of two tanks shall be randomly selected by the Government Inspector, one designated Tank A and the other designated Tank B, and subjected to the tests listed under Tank A and B in the order indicated. The 10 tanks for this sampling shall be presented for selection no later than 180 days after date of contract.

Tank A

Examination of product (4.5.1)
Welding inspection (4.5.9 through 4.5.9.3.5)
Weight (4.5.10) and center of gravity
Contour (4.5.12)
Capacity (4.5.2.2)
Functional test of components (4.5.2)
Pressure (4.5.3.1)
Vibration and slosh (4.5.4)
Pressure (4.5.3.2)
Temperature (4.5.5)
115% load (4.5.6)
*150% load (4.5.7)
Force ejection (4.5.8)

*Do not load to failure

Tank B

Examination of product (4.5.1)
Welding inspection (4.5.9 through 4.5.9.3.5)
Weight (4.5.10)
Contour (4.5.12)
Functional test of components (4.5.2)
Pressure (4.5.3)
Vibration and slosh (4.5.4)
Pressure (4.5.3.2)
Functional test of components (4.5.2)
Examination of product (4.5.1)
*150 load (4.5.7)

*Load to failure in the most critical condition

4.3.1 First article test report - The manufacturer shall furnish four (4) copies of the first article test report to the local Government Inspector. The report shall include a detailed summary of all phases of the testing. The test method, test and recording equipment, and the test results shall be reported. All test failures shall be reported even if the failure condition is subsequently corrected and the corrected article is tested satisfactorily. One copy is for retention by the Government Inspector. The other three are to be transmitted to the following: Two copies to the Naval Air Systems Command Headquarters, Washington, D.C. 20360 (Code AIR-530313B) for information and one copy to the Naval Air Development Center, Air Vehicle Technology Department, Warminster, Pa. 18974 (Code 3053) for approval.

4.4 Quality conformance tests - The quality conformance tests shall consist of the Individual and Sampling tests and shall be conducted under the supervision of the Government Inspector.

4.4.1 Individual tests - Each tank submitted for acceptance under the contract shall be subjected to the following tests:

Examination of product (4.5.1)
Functional test of components (4.5.2)
Pressure test of individual tanks (4.5.3.1)

4.4.2 Sampling tests - The contractor shall furnish samples from each lot for the following tests. These tests are described under the "Test Methods" and are to be conducted in the order indicated:

Examination of product (4.5.1)
Functional test of components (4.5.2)
Pressure (4.5.3.1)
Vibration and slosh (4.5.4)

Pressure (4.5.3.2)
Functional test of components (4.5.2)
Examination of product (4.5.1)

The tanks will be selected by the Government Inspector (without preliminary inspection or repair the tanks shall be subjected to the above tests). For the purposes of this paragraph, the lot size shall be set by the contractor, consistent with his production and test capabilities, which will meet the contract delivery schedule and be in accordance with MIL-STD-105 inspection level S-1, acceptance No. zero. Sample tanks shall be in addition to the contract quantity. The contractor is required to build all tanks in each lot prior to the selection of the sample tanks to be tested and the tanks shall not be shipped until satisfactory completion of the tests. Failure of a tank under the sampling tests shall be cause for rejection of all tanks in that lot. The contractor shall take necessary corrective action to eliminate any deficiencies in the rejected tanks. A tank incorporating the corrective action shall be resubmitted for retest. Upon satisfactory retest, the rejected tanks may be submitted for acceptance under the contract upon concurrence of the Government Inspector, based on evidence submitted, that any necessary corrective action has been incorporated into the tanks.

4.4.2.1 Sampling test reports - The requirements of paragraph 4.2.1 shall apply except this report shall be approved by the local Government Inspector.

4.5 Test methods -

4.5.1 Examination of product - The tank shall be examined for conformance with the requirements of this specification with respect to materials, workmanship, design, interchangeability, exterior surface, construction, external finish, markings, contour, and applicable drawings.

4.5.2 Functional test of components -

4.5.2.1 The following describes the tests required on external fuel tanks after complete assembly including installation of all valves, switches, lines and fuel quantity gage, and after leakage test.

4.5.2.2 The following procedure shall be the test procedure for the fuel tank.

4.5.2.2.1 Pressure fueling - While in the 3° 15' -00/+30° nose up altitude the tank, with air and precheck lines closed, shall be fueled at a minimum rate of 50 GPM at 20 PSIG. When approximately one half full while fueling the tank via the precheck line, the precheck valve shall actuate the automatic shutoff. Remove the pressure from the precheck system and continue as described above until automatic shutoff. Record the gross fuel quantity.

4.5.2.2.2 Pressure transfer - Following pressure fueling, place the tank in the $6^{\circ} + 30^{\circ} - 00$ nose up altitude condition and pressurize with air at 25 PSIG. Fuel shall be transferred from the fuel tank. The low level pilot shall shut off the fuel flow. The useable fuel shall be recorded and be within the limits of 3.3.2.2.

4.2.5.3 Fuel quantity gaging system - While the fuel tank is in the $4^{\circ}30' - 5^{\circ}15'$ nose up altitude and the fuel forward probe capacitance reading shall be $33.07 \pm .5$ mmf and the aft probe $26.75 \pm .5$ mmf. With the tank in the full condition the capacitance reading shall be $3824.84 \pm .5\%$ mmf for the forward probe and $3618.51 \pm .5\%$ mmf for the aft probe.

4.5.3 Pressure test - The pressure relief valve and other opening, except one for applying pressure, shall be sealed and the tank shall be subjected to the pressure test of 4.5.3.1 or 4.5.3.2 as applicable. During these tests, leakage of the tank shall be detected by submersion of the tank in water or by filling the tank with a florescent dye and examining the exterior surface of the tank with an ultraviolet lamp.

4.5.3.1 Pressure test of individual tanks - Each production tank shall be pressure tested to an internal negative pressure of 2.0 PSIG for 3 minutes, an internal positive pressure of 40.25 PSIG for 3 minutes and an internal positive pressure of 35 PSIG for 15 minutes. These tests shall be made without leakage or failure except a leakage check is not required on the negative pressure test.

4.5.3.2 Pressure test for first article and sampling test - Following the slosh and vibration tests, the tank shall be subjected to an internal positive pressure of 40.25 PSIG for 3 minutes without permanent deformation then a negative pressure of 4 PSIG for 3 minutes and a positive pressure of 70 PSIG for 15 minutes without leakage or failure, permanent deformation is permitted.

4.5.4 Vibration and slosh - The tank shall be subjected to the vibration and slosh tests as specified in MIL-V-7173 except that the 25 hours shall consist of 12 1/2 hours in the pitch condition and 12 1/2 hours in the roll condition. The centerline of the tank shall be at least 20 inches above the slosh axis. The tank shall be pressurized to 25 PSIG during the test. The minimum displacement measured adjacent to rear lug shall be 0.032 inches double amplitude. Measurement of the displacement shall be accomplished by means of a suitable electronic measuring device whose pickup is permanently attached to the tank. There shall be no evidence of leakage, failure, or excessive wear. The tank shall then be pressure checked to the applicable values of paragraph 4.5.3.2 and functional checked in accordance with 4.5.2.

4.5.5 Temperature test - The tank shall be dried for one day at a temperature of $160 \pm 5^{\circ}$ F. The tank then shall be filled with fluid conforming to MIL-F-5624 containing a satisfactory staining agent and shall be cooled to $-65^{\circ}\text{F} \pm 5$ for a period of 3 days. The tank then shall be drained and examined

for any unsatisfactory condition or indication of fluid leakage. During the temperature drop, warm up and leak check phase of this test, the tank shall be pressurized at 25 PSIG. Any leakage shall be considered as a tank failure. All joints, seams, and fittings shall be covered with brown paper to aid in determining leakage.

4.5.5.1 Alternate leakage test - In lieu of the method employing a staining agent and brown paper, the leakage test may be conducted by using test fluid in accordance with MIL-F-5624 containing a fluorescent dye and examining the exterior surface of the tank with an ultraviolet lamp.

4.5.6 115% load test - Static loads equal to 115% of the design limit loads contained in Table I shall be applied to the tank without permanent deformation or failure. During the test the tank shall be pressurized to 28 PSIG.

4.5.7 150% load test - Following the completion of the tests specified in paragraph 4.5.6, the tank, while pressurized to 28 PSIG, shall be subjected to 150% of the design limit loads for the conditions specified in Table I. The 150% design limit load static test shall be accomplished without a tank failure.

4.5.8 Force ejection - The tank shall withstand one release from the bomb rack without being ruptured. The tank shall be full during this test with an equivalent amount of water to simulate a tank filled with JP-5 fuel. The ejection mechanism will be provided by the Naval Air Systems Command. (JP-5 fuel is 6.8#/GAL)

4.5.9 Welding inspection - The following inspection and acceptance criteria are applicable.

4.5.9.1 X-Ray inspection - X-Ray inspection shall be performed on a 5 percent sample basis. The sample shall be based upon the number of tanks to be furnished on each lot and shall be representative of the entire production lot. Failure of the sample to comply with the weld acceptance criteria of this contract shall result in rejection of all welds until the contractor has demonstrated to the local government authority that the failure condition has been corrected. In the event the contractor cannot propose a procedure satisfactory to the local government authority to correct the failure condition, the local government authority shall invoke 100% X-Ray inspection. Negatives of the welds shall be forwarded with the first article test report.

4.5.9.2 Dye penetrant inspection - A dye penetrant inspection shall be performed on all welds of each tank.

4.5.9.3 Defects - Cracks, lack of fusion, and incomplete weld penetration in any form are unacceptable. Unless otherwise specified, the dimension "T" is defined as the nominal parent metal thickness of the thinnest joint member.

4.5.9.3.1 Porosity and inclusions - For the purposes of this specification, the diameter of any porosity cavity shall be defined as its largest dimension. Interconnected porosity shall be considered a single cavity. Inclusions, either tungsten or nonmetallic, shall be subject to the same dimensional limitations as porosity. When both inclusions and porosity are present, the sum of their areas shall fall within the limitations defined for porosity (either total or aligned, as applicable).

4.5.9.3.2 External defects - The following external defects are rejectable:

(a) Cracks shall not be acceptable in the weld metal or adjacent base metal. Cracks occurring in the weld bead reinforcement area (root and face) may be removed.

(b) Unless otherwise noted, oxide folds and suckbacks are acceptable if the thickness in the area is not less than the minimum sheet or plate thickness allowed in the material specification and/or the drawing tolerance for machined or formed sheets or parts, whichever is applicable.

(c) Discontinuities exposed to the surface are acceptable providing the linear dimension and total area values do not exceed the corresponding radiographic limits specified for all internal discontinuities.

4.5.9.3.3 Internal defects - (radiographic Requirements) The following internal defects are rejectable:

(a) Cracks are not acceptable in the weld or adjacent base metal.

(b) Porosity, voids and oxide inclusion defects shall be limited as follows:

1. Maximum Pore Size: Unconnected voids shall not exceed a linear dimension greater than 50% of the weld bead thickness or shall not exceed a diameter of .050 (1/20) inches, whichever is smaller.

2. The summation of all unconnected void areas in any linear inch of weld shall not exceed 7% of an area equal to (1 in. X T) sq. in. Aligned porosity shall not exceed 3.5% of an area equal to (1 in. X T) sq. in.

3. Porosity pores smaller than 0.00008 sq. in. in area are considered non-detrimental and need not be evaluated.

4. Weld metal radiograph images which appear to have pores that overlap, but each pore can be differentiated from the other by Radiographic Triangulation, shall be evaluated as separate pores.

4.5.9.3.4 Stringer discontinuity - A stringer discontinuity is defined, for the purpose of X-Ray interpretation, as an oxide stringer, or a series of stringers in a linear distribution when the ratio of the major dimension to the minor dimension of an individual discontinuity is 5:1 or greater. The stringer discontinuity shall be considered a single stringer where the adjacent discontinuities are not separated by a length equal to or greater than 15% of "T."

A stringer discontinuity is permissible if: The summation of all connected or aligned stringers do not exceed a total area of 0.060 (60/1000) sq. in. in any 6.0 inch length of weld and occurs in the weld bead reinforcement areas (root and face).

4.5.9.3.5 Undercutting - Undercutting shall be cause for rejection if it is in excess of $1/10$ T in depth. Undercutting of any depth less than $1/10$ T shall not exceed one inch on weld length. "T" is the thickness of the parent metal adjacent to the undercut.

4.5.10 Weight - The tank shall be checked for conformance with the requirements of paragraph 3.8 herein.

4.5.11 Contour - The tank shall be checked for conformance with the requirements of paragraph 3.9 herein.

5. PREPARATION FOR DELIVERY

5.1 Preservation - The tanks shall be protected internally during shipment and storage by the application of Type III mixture conforming to MIL-C-6529. Particular care shall be exercised to insure complete coverage of all internal surfaces and to insure adequate drainage of the excess compound.

5.1.1 Fittings - All fittings shall be preserved in accordance with Method 1(a) MIL-P-116 and securely packaged in an interior paperboard corrugated fiberboard container conforming to PPP-B-636, Type I, Class 2. The packaged fittings shall be secured to the interior face of the tank shipping container.

5.1.2 Closures - The tank interior shall be protected against the entrance of dirt or other foreign material by sealing the exterior openings in accordance with MIL-C-5501. During shipment and storage, the tank shall be vented through the fuel line to compensate for thermal changes.

5.2 Packing - Each assembled tank and the accessories to accompany the tank, as defined in the contract or order, shall be packed in an open crate conforming to MIL-C-9437. The boxes containing the accessories shall be so distributed as to insure that the center of balance of the crate is approximately at the midpoint of the long dimension. Crates containing tanks shall be capable of meeting the rough handling test of MIL-STD-794.

5.2.1 Cushioning - Tanks and accessories shall be securely mounted in the crate. The tank shall be secured to the crate insofar as practicable by its aircraft suspension points. Saddles or other blocking shall be used only to prevent excessive motion of the tank in the crate. Blocking, bracing and cushioning shall be designed as to withstand the tests specified herein when the crate is loaded and fully assembled for surface shipment.

5.2.2 Package contents - Each shipping container shall contain all the necessary plumbing fittings and equipment required for the complete assembly and installation of each tank packaged within the container.

5.3 Marking - Shipping container shall be marked in accordance with MIL-STD-129.

TABLE I
STATIC TEST LOADS

CONDITION	P_x lbs	P_x lbs	P_z lbs	M_x in-lb	M_x in-lb	M_z in-lb	TAIL LOAD P_z
6	3431	1375	-13980	5058	45925	-96126	2626
196L	4370	3170	-16024	-11770	-213935	82350	1880
CATAPULT	8500	-	-	-	-	-	-

DESIGN LIMIT LOAD

1. Loads and moments at tank CG
2. Ultimate load = 150% design limit load
3. Tail load distributed evenly over the two tail surfaces

POSITIVE SIGN CONVENTION